

Claims

- [c1] 1. An in-situ plasma cleaning device for performing an atomic surface cleaning process to remove contaminants, comprising:
a cleaning assembly;
a magnetic field generator, located within the cleaning assembly, that generates a generally axially directed magnetic field to provide a plasma for cleaning a surface within the cleaning assembly;
wherein the cleaning assembly comprises a collector shield disposed opposite to the surface to be cleaned for collecting the contaminants and by-product material.
- [c2] 2. The in-situ plasma cleaning device of claim 1, wherein the cleaning assembly traverses the length of a target cylindrical surface and a substrate cylindrical surface during a cleaning process.
- [c3] 3. The in-situ plasma cleaning device of claim 2, wherein the target cylindrical surface and substrate cylindrical surface are cleaned concurrently.
- [c4] 4. The in-situ plasma cleaning device of claim 3, wherein the target cylindrical surface and the sub-

strate cylindrical surface may be cleaned separately.

- [c5] 5. The in-situ plasma cleaning device of claim 4, wherein the in-situ plasma cleaning device is stowable in-situ in the cleaning assembly without requiring the cleaning system to be opened to ambient atmospheric condition.
- [c6] 6. The in-situ plasma cleaning device of claim 5, further comprising a plurality of target cleaning assemblies and a plurality of substrate cleaning assemblies.
- [c7] 7. The in-situ plasma cleaning device of claim 6, wherein the target cleaning assemblies and the substrate cleaning assemblies comprise a modular interconnection.
- [c8] 8. The in-situ plasma cleaning device of claim 7, wherein the atomic surface cleaning is performed selectively on a substrate cylindrical barrel.
- [c9] 9. The in-situ plasma cleaning device of claim 7, wherein the atomic surface cleaning is performed selectively on a target cylindrical tube.
- [c10] 10. The in-situ plasma cleaning device of claim 1, wherein the atomic surface cleaning of the in-situ plasma cleaning device is performed in a closed vol-

ume process to eliminate a possibility of recontamination.

- [c11] 11. The in-situ plasma cleaning device of claim 1, wherein the plasma is tuned to attain predetermined properties for a target material and a substrate material.
- [c12] 12. The in-situ plasma cleaning device of claim 11, wherein the plasma is tuned by adjusting a strength of a magnetic field of the magnetic assemblies.
- [c13] 13. The in-situ plasma cleaning device of claim 6, wherein the substrate cleaning assembly comprises a magnet assembly configured to generate a substrate cleaning magnetic field in an axial direction.
- [c14] 14. The in-situ plasma cleaning device of claim 6, wherein the substrate cleaning assemblies comprise a substrate cleaning end cap assembly.
- [c15] 15. The in-situ plasma cleaning device of claim 14, wherein the substrate cleaning end cap assembly comprises a plurality of roller blocks for supporting the in-situ plasma cleaning device during operation and movement.
- [c16] 16. The in-situ plasma cleaning device of claim 6,

wherein the target cleaning assemblies comprise a target cleaning end cap assembly.

- [c17] 17. The in-situ plasma cleaning device of claim 16, wherein the target cleaning end cap assembly comprises a plurality of roller blocks for supporting the in-situ plasma cleaning device during operation and movement.